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Count variation Effect on physical properties of Single jersey Cotton-elastane knittedFabric.

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Abstract: *This paper deals with the result of an investigation by using different count yarn but same parameters of knitting machine to produce cotton-elastane single jersey fabric. Here,the all parameters of knitting machine including gauge, dia ,Stitch length, rpm, machine tension etcare same. Dyeing process also carried out at same parameter for all fabrics. Finishing process like Heat setting, Stentering, compacting are done in same condition But we use different count cotton yarn. In this paper, we mainly deal with the physical properties of single jersey cotton fabric. we try to identify how the properties of single jersey knitted fabric like fabric diameter(gray& finished condition) ,WPI&CPI(gray& finished condition),Fabric GSM(gray& finished condition),Shrinkage (%) length &width wise, spiralityare changing with Count .Finally the findings are as expected with some variation with the result that are thought theoretically.*

Keywords**:** *Circular knitting Machine, Machine dia, gauge, count, GSM, Fabric diameter, WPI, CPI etc*.

I. Introduction:

Knitting is a technique for producing a two-dimensional fabric made from a one-dimensional yarn or thread. It is the method of creating fabric by transforming continuous strand of yarn into series of interlooping loops, each row of such loops hanging from the one immediately preceding it[1]. The basic element of a knit fabric structure is the loop intermeshed with the loops adjacent to it on both side and above and below it. knitted fabrics are divided into two major groups, weft & warp knitted fabric[3]. Weft knitted fabrics can be produced in circular or flat knitting machine. The primary knitting elements of circular knitting machines are needle,cam,sinker. The rising demand on knitted garments all over the world motivate the researcher to research about various knitted fabric, production processes, developing new structures[2].kmittingmachines comprise a needle holder that supports a plurality of needles, which are arranged side by side and can be actuated with an alternating motion along their axis with respect to the needle holder in order to form knitting. Single cylinder circular knitting machines are generally provided, at the upper end of the needle cylinder,with an annular element which is fixed integrally around the upper end of the needle cylinder and isprovided with radial cuts, inside each of which a sinker is arranged, and this radial cuts are angularly offset around the needle cylinder axis with respect to the needle sliding channels so that each sinker is located between two contiguous needles [4]. In the circular knitting machine with a great number of knitting needles, when the number of needle increases, the distance between the needles or sinkers have to be shrunk [5]. Different count yarns produce different knit fabric. The properties of knit fabric are changing with change of count of the yarn by keeping the parameters of knitting machine (dia, gauge, stitch length) same in every case. Properties of knitted fabric like GSM, CPI,WPI, shrinkage(length & width wise),spiralityetc are showing different value in different count yarn .In this paper we want to see how much these value are changed with the changing of count of yarn. Here,We use four different count yarn.

II. Materials &Method

2.1 Materials

2.1.1. yarn selection

As the experiment has done to see the variation of properties of knitted fabric ,we use different count yarn like 24/1,26/1,30/1,34/1 Ne for our experiment. And we use 20D spandex yarn. Composition of knitted fabric in every case 95% cotton &5% spandex .

2.1.2 .Machine

Knitting machine(Mayer&cie,Germany) with same diameter &gauge have been used .And every experiment stitch length has kept 3.05mm.

2.2.Methods

2.2.1. Batching

Batching is an operation which is done after knitting before dyeing or wet processing. All fabrics have undergone through the same dyeing operation or wet processing .The four fabrics(four different count) have joined in the same batch by stitching the ends of fabric.but all the fabrics has given a identified mark which had done to identity the fabric after dyeing & finishing.

2.2.2**.** Finishing and Dyeing

Finishing has a strong impact on fabric properties. The finishing process had done in several steps. Firstly slitting has done immediately after dyeing to make the tube fabric open by cutting the tube fabric through a preset needle line.
Then Heat Set had done by the following parameter in stenter machine (sun super brand)
Temperature-190 ˚C , Dwell Time-35 S, Speed-12 RPM, Over Feed- 40%,UNDER FEED- 1%.
All the fabrics have been dyed with the same average color in a same machine at the same time .Dyeing process was carried out at 90 ˚c on Ph 9 -10 with M:L ratio 1:8 for 60 minutes.

Then again fabric send to the stentering machine to control the dia of fabric at Temperature-160˚C, Speed-12 RPM, Over Feed - 50%, Under Feed- (-1%).

At last Calendering had done at Temperature-120˚C , Speed-15 RPM , Over Feed- 100%, Under Feed- 0%.

2.2.3.Relaxation

Knitted fabric are very much prone to extend & shrink.so proper relaxation is very much essential before any test. The fabrics had kept at 27˚C temperature & 65% relative humidity at physical lab.

2.2.4. Determination of WPI

After relaxation & conditioning of knit fabric samples, The numbers of wales in a 1” length of fabric were determined at ten different places on every sample with a magnifying glass, and the average values were calculated.

2.2.5. Determinaion of CPI

After relaxation & conditioning of knit fabric samples, The numbers of courses in a 1” length of fabric were determined at ten different places on every sample with a magnifying glass, and the average values were calculated

2.2.6. Determination of Fabric diameter

After relaxation & conditioning, the width of the fabric was measured by measuring tape, for different samples [10].

2.2.7. Determination of Fabric Weight (GSM)

After relaxation & conditioning of knit fabric samples, GSM of samples were tested by taking test samples with the help of GSM cutter & weighting balance (electronic) [11].

2.2.8. Determination of Spirality

First cut a sample of (50cm×50cm) with the scissors. Then by the over lock sewing m/c the 4 ends of the cut fabric were sewn. After sewing, again by a scale mark (35cm×35cm) on the fabric & then sample washed with a standard soap solution (1g/l). After washing the sample was tumble dried at 65°C± 15°C for 60 minutes. Then after cooling the sample tested with the shrinkage tester scale also the spirality was tested. Shrinkage was tested length wise & width wise along the mark of (35cm×35cm). And spirality was tested along sewing line alignment. (Distortion of the formation of loops) [12].

2.2.9. Determination of Fabric Shrinkage

Shrinkage is an inherent property of knit fabrics which can’t be prohibited, but for better quality, it must be controlled in a systematic way. After tumble drying & cooling of the fabric, shrinkage of this samples are in widthwise. It was calculated from the difference in fabric length before and after washed garment according to AATCC test methods 135 and 150[13] .

III. Result and discussion

3.1. Effect on fabric wpi

Here we see when increase the count of yarn,the wales per inch also increase in both cases gray and finished condition. After finishing the wales per inch increasing is lower comparatively gray state. Another important thing we observe that wpi increase rapidly when the count change from 26Ne to 30Ne.

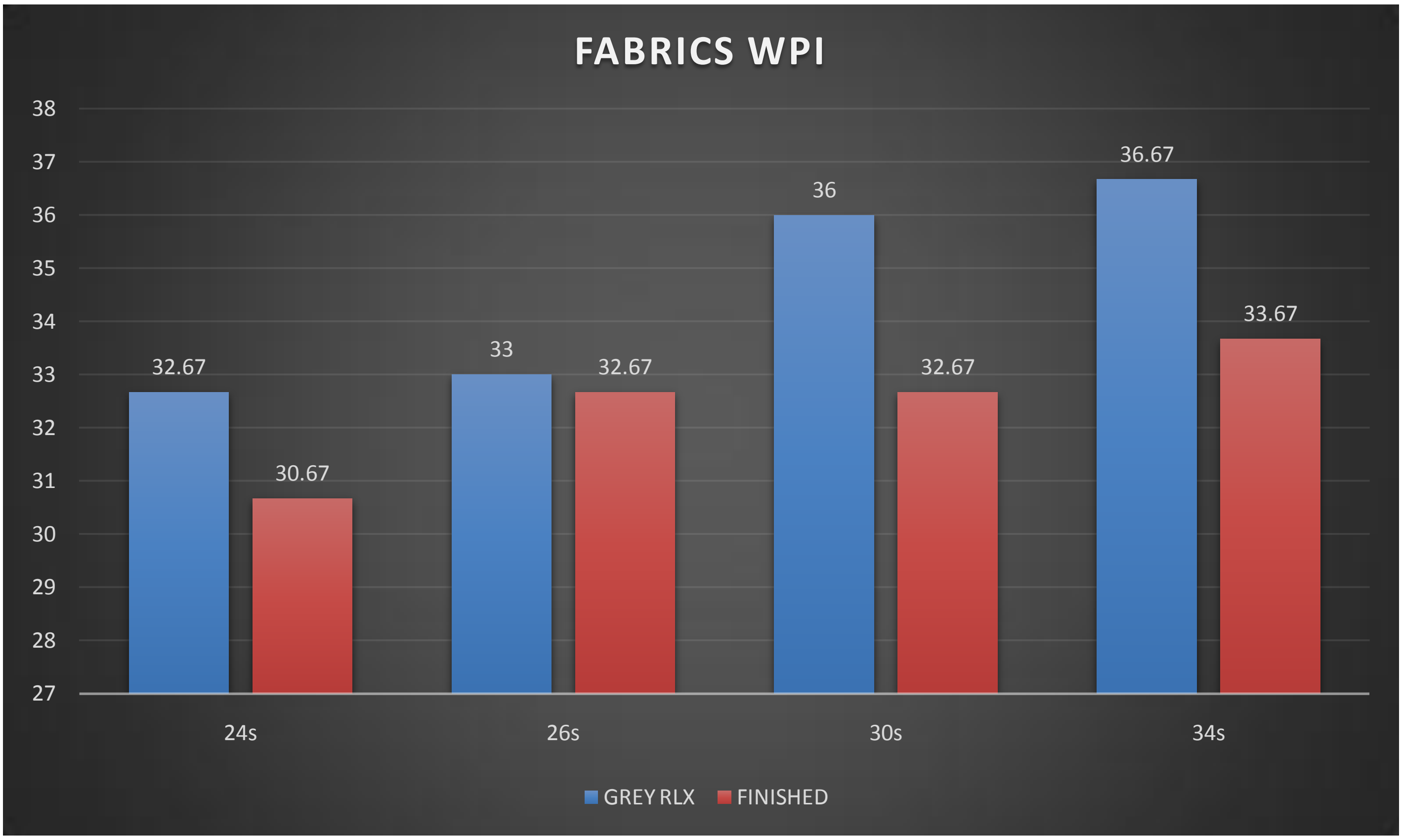
	GAUGE×dia× SL(mm)	WPI (gray)	AVG (gray)	WPI (finish)	AVG (finish)
24 S/1 CH(CTN)+20DELA(FFL)	18×38×3.05	34	32.67	32	30.67
	18×38×3.05	32		30	
	18×38×3.05	32		30	

	GAUGE× DIA× SL(mm)	WPI (gray)	AVG (gray)	WPI (finish)	AVG (finish)
26S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	33	33	32	32
	18×38×3.05	32		32	
	18×38×3.05	34		32	

	DIA×GAUGE× SL(mm)	WPI (Before)	AVG (Before)	WPI (After)	AVG (After)

30S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	36	36	33	32.67
	18×38×3.05	36		32	
	18×38×3.05	36		33	

	DIA×GAUGE× SL(mm)	**WPI (Before)**	**AVG (Before)**	**WPI (After)**	**AVG (After)**
34S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	36	36.67	35	33.67
	18×38×3.05	36		34	
	18×38×3.05	38		32	



3.2 Effect on fabric cpi

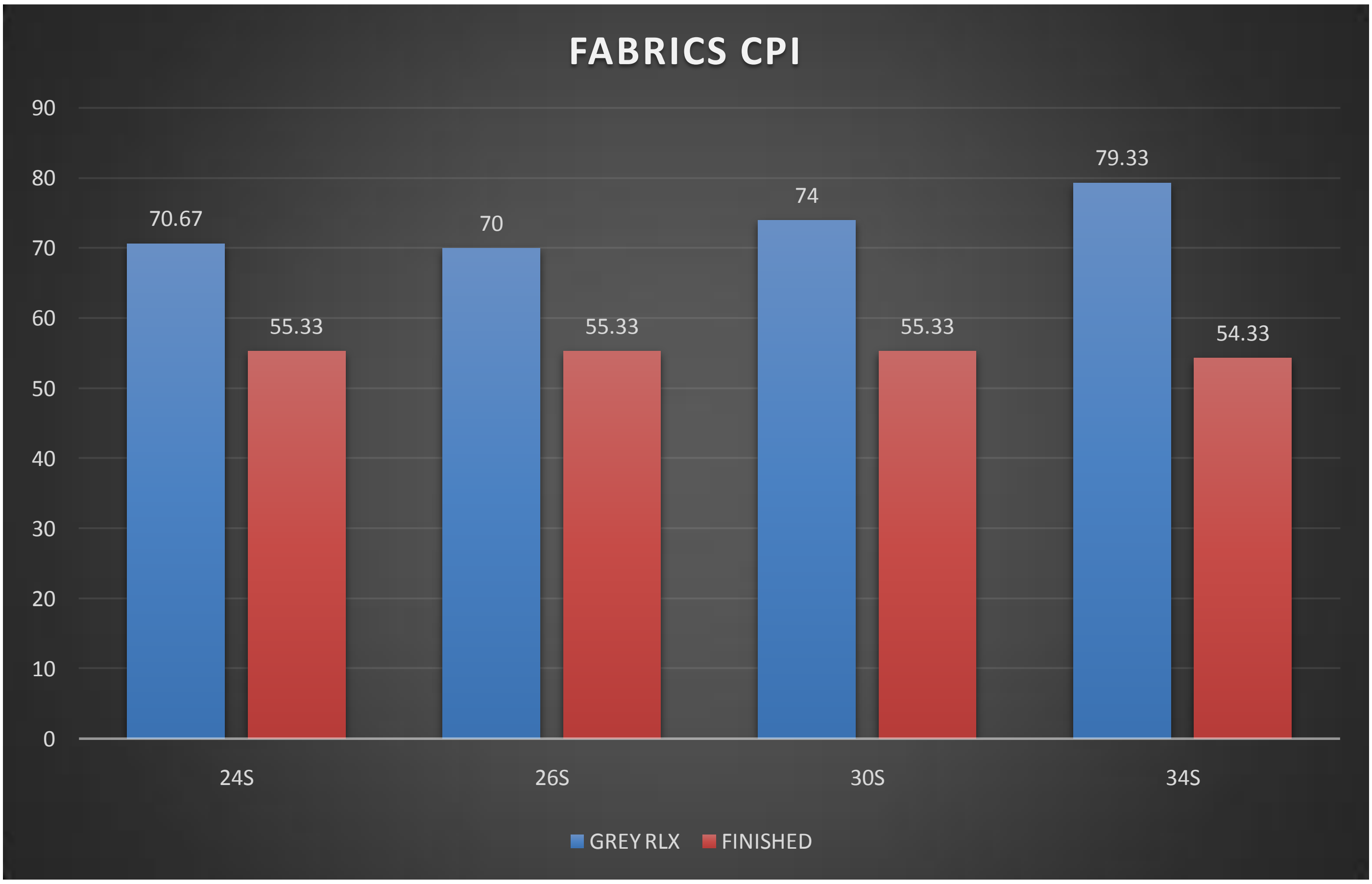
Here the course per inch increase in the single jersey knitted fabric with the increase of count of yarn but incase of finished fabric the course per inch does not increase as rapidly as in gray condition.

	GAUGE×DIA× SL(mm)	CPI (Gray)	AVG (gray)	CPI (finish)	AVG (finish)
24 S/1 CH(CTN)+20DELA(FFL)	18×38×3.05	70	70.67	56	55.33
	18×38×3.05	72		56	
	18×38×3.05	70		54	

	DIA×GAUGE× SL(mm)	CPI (gray)	AVG (gray)	CPI (finish)	AVG (finish)
26S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	72	70	60	55.33
	18×38×3.05	68		56	
	18×38×3.05	70		50	

	GAUGE× DIA×SL(mm)	CPI (gray)	AVG (gray)	CPI (finish)	AVG (finish)
30S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	72	74	54	55.33
	18×38×3.05	78		58	
	18×38×3.05	72		54	

	GAUGE× DIA×SL(mm)	CPI (gray	AVG (gray)	CPI (finish	AVG (finish)
34S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	78	79.33	53	54.33
	18×38×3.05	80		54	
	18×38×3.05	80		56	



3.3 Effect on fabric diameter

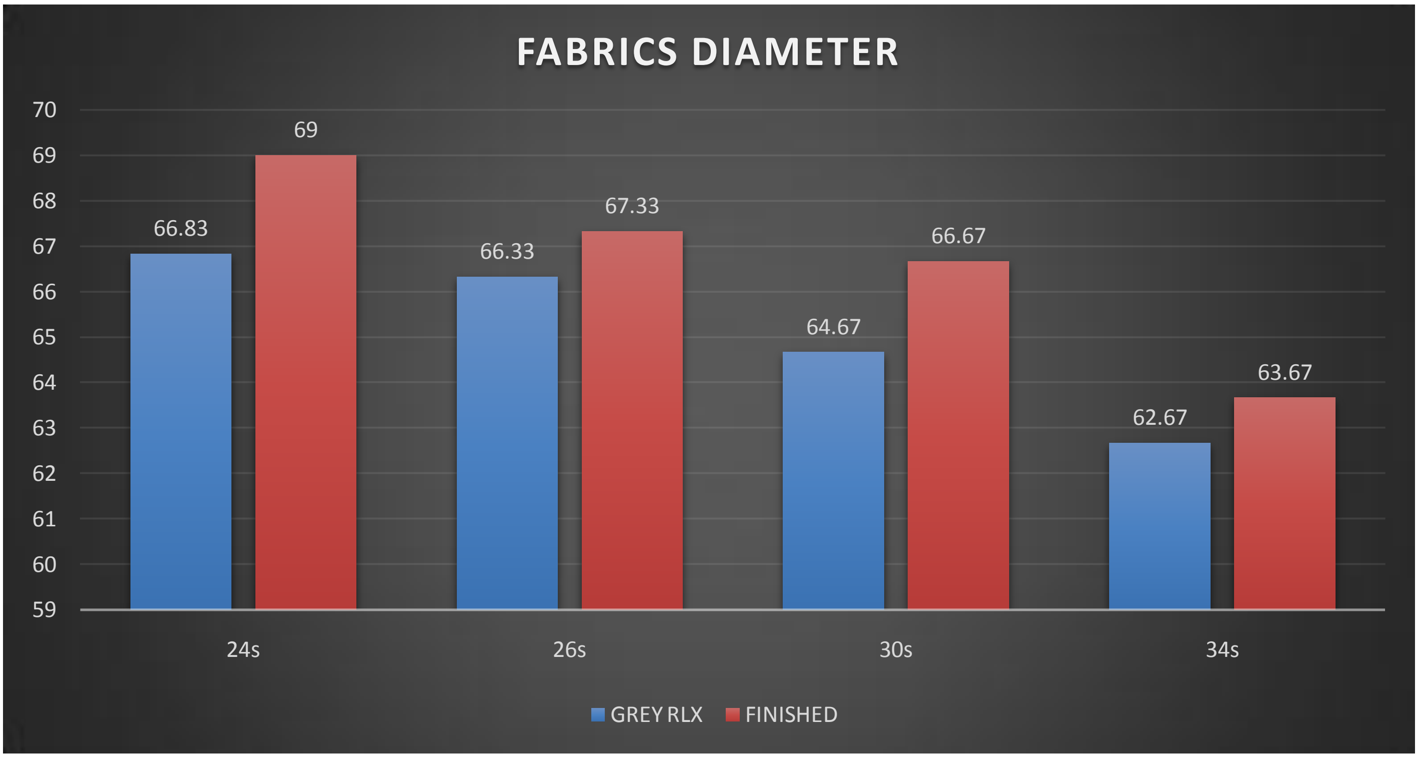
Fabric diameter decreases when the count of yarn increases during gray and finished condition.

	GAUGE× DIA× SL(mm)	DIAMETER (gray)	AVG ((gray	DIAMETER (finish)	AVG (finish)
24 S/1 CH(CTN)+20DELA(FFL)	18×38×3.05	67	66.83	68	69
	18×38×3.05	67		68	
	18×38×3.05	66.5		71	

	GAUGE× DIA× SL(mm)	DIAMETER (gray)	AVG ()(gray	DIAMETER (finish)	AVG (finish)
26S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	67	66.33	66.5	67.33
	18×38×3.05	65		66.5	
	18×38×3.05	67		69	

	GAUGE× DIA× SL(mm)	DIAMETER (gray)	AVG ((gray)	DIAMETER (finish)	AVG (finish)
30S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	63.5	64.67	66.5	66.67
	18×38×3.05	67		67	
	18×38×3.05	63.5		66.5	

	GAUGE× DIA× SL(mm)	DIAMETER (gray)	AVG (gray)	DIAMETER (finish)	AVG (finish)
34S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	62	62.67	62.5	63.67
	18×38×3.05	62		63.5	
	18×38×3.05	64		65	



3.4. Effect on fabric GSM

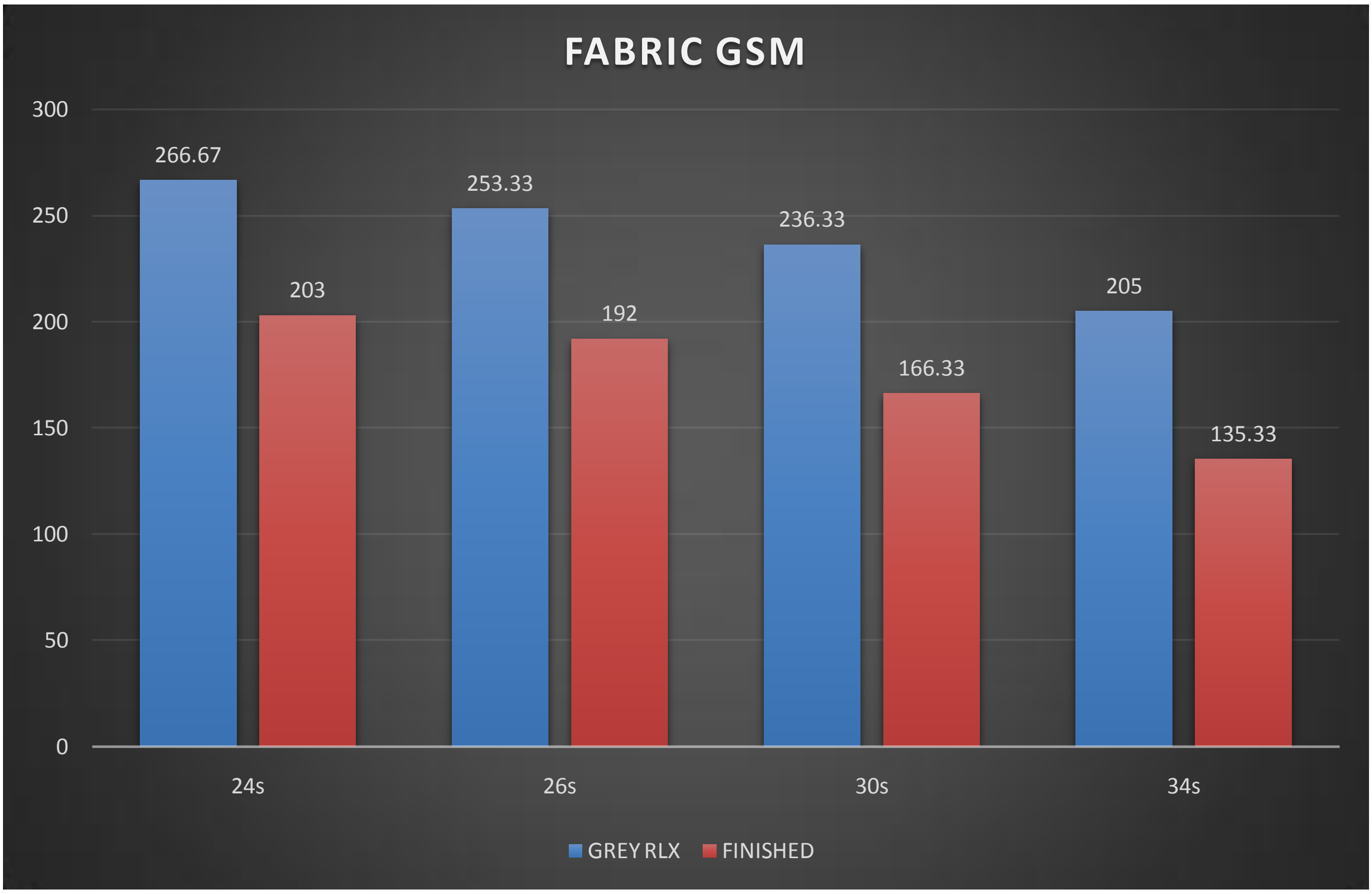
The GSM of the knitted fabric decrease with increase of count of yarn but the change of GSM is very rapid in case of finished fabric which we see the curve.

	GAUGE× DIA× SL(mm)	**GSM (gray)**	**GSM (gray)AVG**	**GSM (finish)**	**GSM (finish)AVG**
24 S/1 CH(CTN)+20DELA(FFL)	18×38×3.05	271	266.67	200	203
	18×38×3.05	265		210	
	18×38×3.05	264		199	

26S/1 CH(CTN)+20D ELA(FFL)	**GAUGE× DIA× SL(mm)**	**GSM (gray)**	**GSM (gray)AVG**	**GSM (finish)**	**GSM (finish)AVG**
	18×38×3.05	254	253.33	182	192
	18×38×3.05	251		189	
	18×38×3.05	255		205	

30S/1 CH(CTN)+20D ELA(FFL)	**GAUGE× DIA× SL(mm)**	**GSM (gray)**	**GSM (gray) AVG**	**GSM (finish)**	**GSM (finish) AVG**
	18×38×3.05	237	236.333	165	166.33
	18×38×3.05	236		169	
	18×38×3.05	237		165	

	GAUGE× DIA× SL(mm)	**GSM (gray)**	**GSM (gray) AVG**	**GSM (finish)**	**AVG GSM (finish)**
34S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	203		136	
	18×38×3.05	207	205	140	135.33
	18×38×3.05	205		130	



3.5. Effect on fabric Shrinkage

The value of shrinkage percentage in single jersey knitted fabric is getting lower with the increase of count of yarn both in length wise and width wisebut the effect is more prominence in widthwise of the fabric.

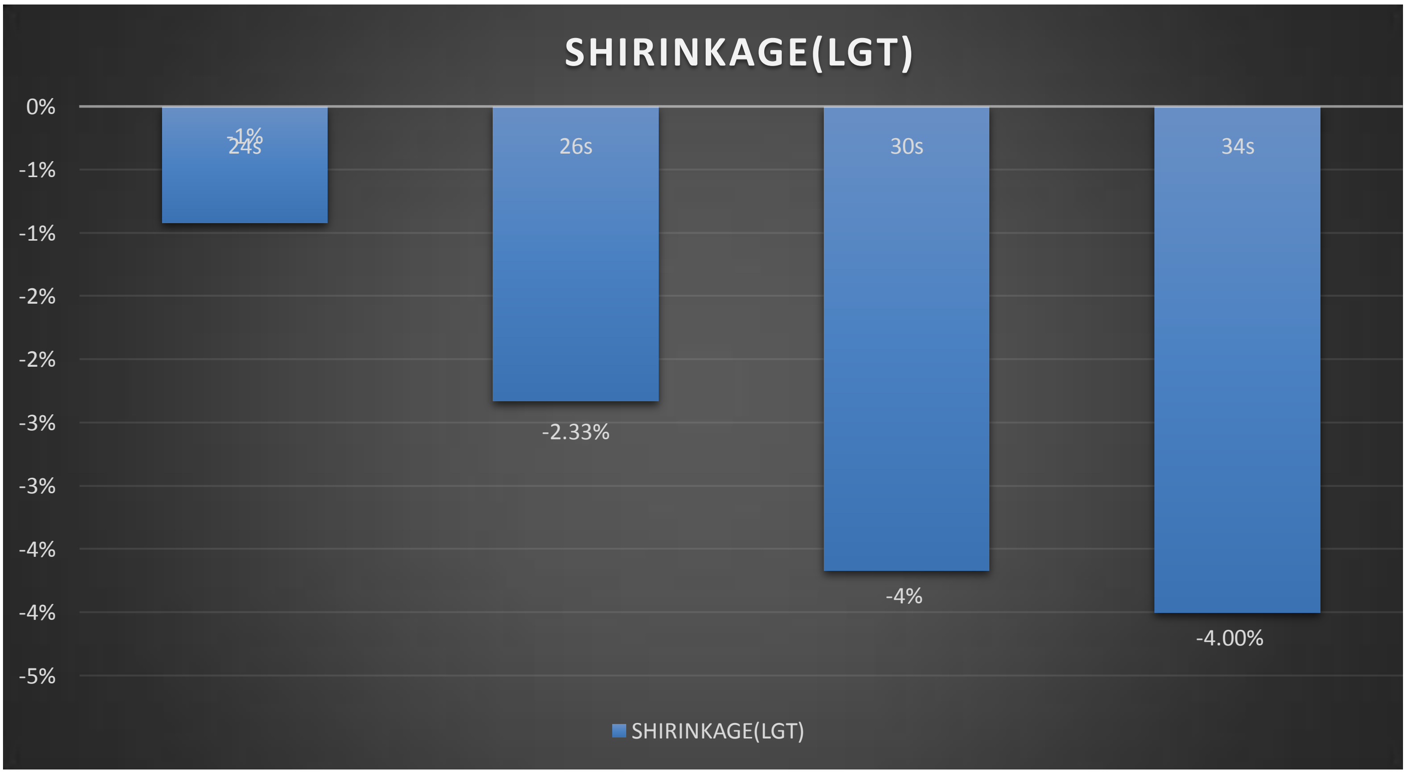
3.5.1 Shrinkage value width wise

	GAUGE× DIA× SL(mm)	SHIRINKAGE (finished, Length wise)	AVG
24 S/1 CH(CTN)+20DELA(FFL)	18×38×3.05	-1%	-0.92%
	18×38×3.05	-1%	
	18×38×3.05	-0.75%	

	GAUGE× DIA× SL(mm)	SHIRINKAGE (finished, Length wise)	AVG
26S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	-3%	-2.33%
	18×38×3.05	-2%	
	18×38×3.05	-2%	

	GAUGE× DIA× SL(mm)	SHIRINKAGE (finished, Length wise)	AVG
30S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	-4%	-3.67%
	18×38×3.05	-3%	
	18×38×3.05	-4%	

	GAUGE× DIA× SL(mm)	**SHIRINKAGE (finished, Length wise)**	**AVG**
34S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	-4%	-4%
	18×38×3.05	-4%	
	18×38×3.05	-4%	



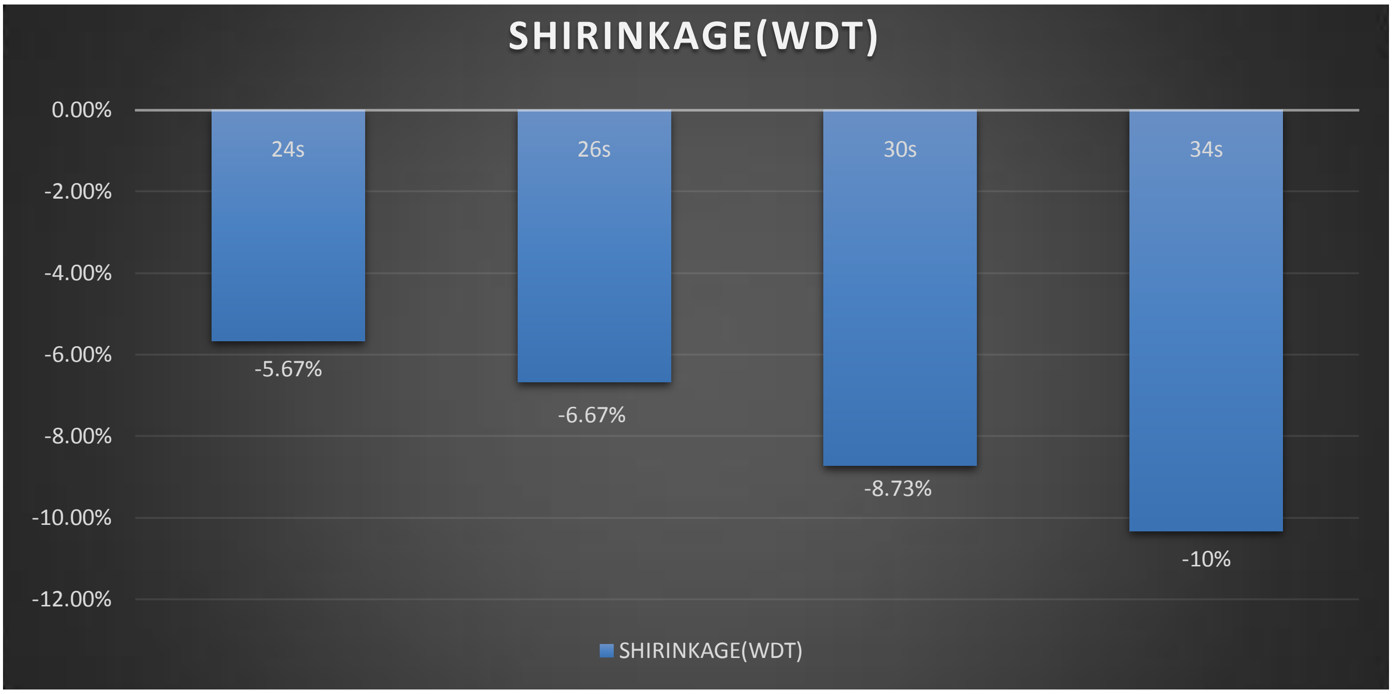
3.5.2 Shrinkage value widthwise

	GAUGE× DIA× SL(mm)	SHIRINKAGE (WDT)	AVG
24 S/1 CH(CTN)+20DELA(FFL)	18×38×3.05	-5%	-5.67%
	18×38×3.05	-4%	
	18×38×3.05	-8%	

	GAUGE× DIA× SL(mm)	SHIRINKAGE (WDT)	AVG
26S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	-5%	-6.67%
	18×38×3.05	-7%	
	18×38×3.05	-8%	

	GAUGE× DIA× SL(mm)	SHIRINKAGE (WDT)	AVG
30S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	-9%	-8.73%
	18×38×3.05	-9%	
	18×38×3.05	-8%	

	GAUGE× DIA× SL(mm)	SHIRINKAGE (WDT)	AVG
34S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	-10%	-10.33%
	18×38×3.05	-10%	
	18×38×3.05	-11%	



3.6.Effect on fabric Spirality

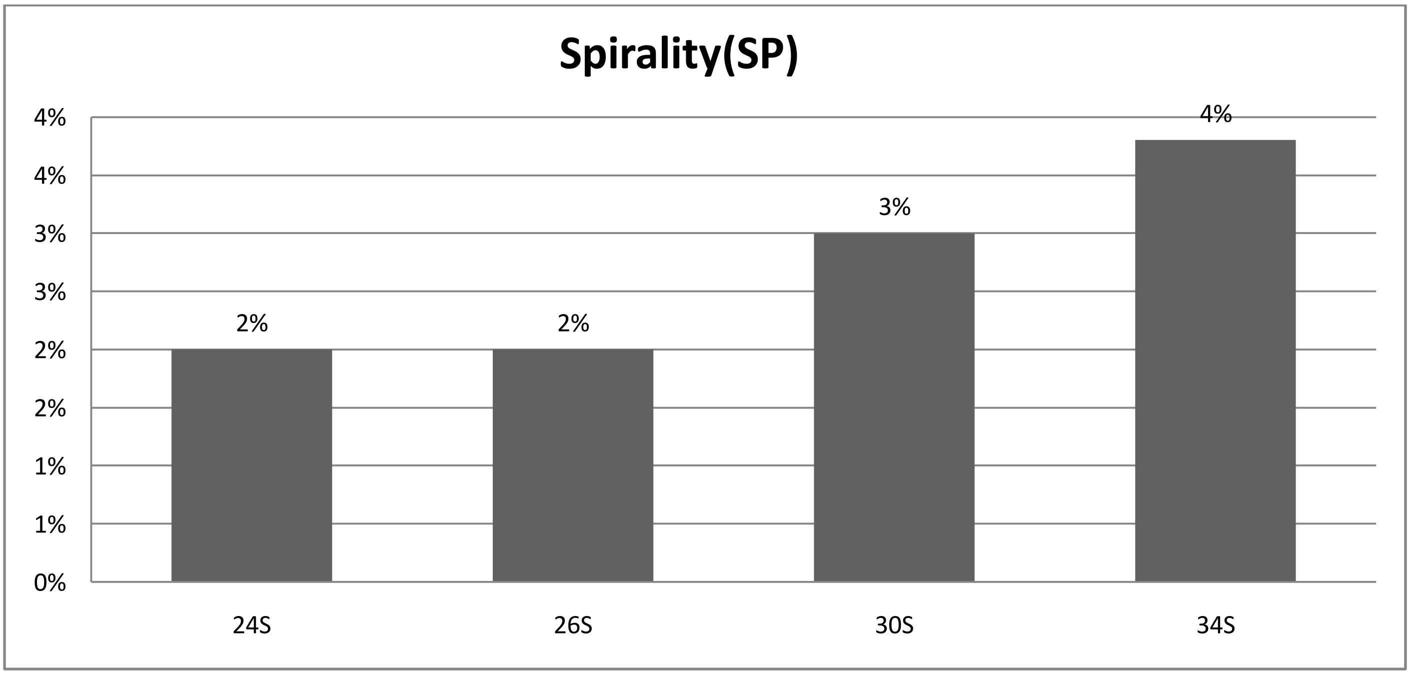
Spirality values also vary with count of yarn but the value is changing rapidly when count difference is more like we see in the chart the avg. value of spirality is same for 24Ne &26Ne .But the value is different for 26Ne &30 Ne count single jersey knitted fabric.

	GAUGE× DIA× SL(mm)	Spirality (SP)	AVG
24 S/1 CH(CTN)+20DELA(FFL)	18×38×3.05	3%	2%
	18×38×3.05	1%	
	18×38×3.05	2%	

26S/1 CH(CTN)+20D ELA(FFL)	**GAUGE× DIA× SL(mm)**	**Spirality (SP)**	**AVG**
	18×38×3.05	2%	2%
	18×38×3.05	2%	
	18×38×3.05	2%	

30S/1 CH(CTN)+20D ELA(FFL)	**GAUGE× DIA× SL(mm)**	**Spirality (SP)**	**AVG**
	18×38×3.05	3%	3%
	18×38×3.05	3%	
	18×38×3.05	3%	

	GAUGE× DIA× SL(mm)	Spirality (SP)	AVG
34S/1 CH(CTN)+20D ELA(FFL)	18×38×3.05	4%	3.8%
	18×38×3.05	4%	
	18×38×3.05	3%	



IV. Conclusion

Yarn count is the most important factor&plays a vital role in most of the physical properties of single jersey knitted fabric.Single jersey fabric production is very common in knitting industry all most all of the knitting factory are producing single jersey fabric by using different count yarn.Most of the properties of single jersey fabric are vary with the changing count of yarn.That's why it is very important not only for the manufacturers but also for the buyers of single jersey fabric to know how much the properties are changing with the using of different count of yarn. In this paper we try to show this.

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